

Euprymna pardalota sp. nov. (Cephalopoda: Sepiolidae), a new dumpling squid from northern Australia

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ABSTRACT

Examination of specimens of *Euprymna* Steenstrup, 1887 from northern Australia led to the discovery of a new species. It is described here as *Euprymna pardalota* sp. nov. It is distinguished from all but one other nominal species of *Euprymna* (*E. phenax* Voss, 1962) in having two rows of suckers on the arms, rather than four rows. It differs from *E. phenax* in a number of traits, including: the possession of large spots over most of the body, the shape of the funnel organ, the modification of the hectocotylus, and spermatophore length and structure. In addition, the discovery among the Australian Museum collection of a specimen of *E. phenax*, previously known only from the single male holotype, supports the validity of this taxon, which was previously described as unresolved.

KEYWORDS: Cephalopoda, Sepiolidae, sepiolid, *Euprymna*, *Euprymna phenax*, *Euprymna pardalota*, dumpling squid.

INTRODUCTION

The most recent review of the genus *Euprymna* Steenstrup, 1887 is that of Norman & Lu (1997). In that work, 12 nominal species were recognised, with five species considered valid: *E. berryi* Sasaki, 1929; *E. hoylei* Adam, 1986; *E. morsei* (Verrill, 1881); *E. scolopes* Berry, 1913; *E. tasmanica* (Pfeffer, 1884) and an undescribed species, *E. sp. 1*. Two species, *E. schneehageni* (Pfeffer, 1884) and *E. pusilla* (Pfeffer, 1884), were considered to be *nomen dubia*, and the status of *E. albatrossae* Voss, 1962; *E. bursa* (Pfeffer, 1884), *E. phenax* Voss, 1962 and *E. stenodactyla* (Grant, 1833) was deemed to be unresolved. In the same year, an additional species, *E. hyllebergi* Natewathana, 1997, from the Andaman Sea, Thailand, was described. More recently, another species, *Euprymna megaspadicea* Kubodera & Okutani, 2002 has been recognised from Japan.

In Norman & Lu's (1997) paper, only one species, *E. tasmanica*, was reported to occur in Australia. It is found in shallow waters around southern Australia from Moreton Bay, Queensland, through to Bass Strait, Victoria. However, two unresolved taxa, one from northern Australia and one from south-western Australia, were mentioned by Norman & Lu (1997). The morphology of the northern unresolved taxon (treated as *E. stenodactyla* in Lu & Phillips (1985)) is described as very similar to that of *E. tasmanica*, although DNA analyses has demonstrated that it is distinct (M. Nishiguchi unpublished data). The second unresolved taxon, also very similar to *E. tasmanica*, is described

by Norman & Lu (1997) as represented by insufficient material to fully resolve. (For this reason, the distribution of *E. tasmanica* in Reid & Jereb (2005) is described as extending north to Shark Bay in Western Australia.) All the abovementioned Australian species have four transverse rows of suckers on the arms.

A visit to the Museum and Art Gallery of the Northern Territory in 2008 led to the discovery of a distinct species of *Euprymna* collected in northern Australian waters. More specimens were subsequently found among the collections of the Western Australian Museum and the Australian Museum. Unlike nearly all other nominal *Euprymna* species, this one has two transverse rows of suckers on the normal (non-hectocotylised arms). The only described species with two rows of suckers is *E. phenax* from the Philippines. Comparison of the Australian material with the *E. phenax* holotype (previously the only known specimen) indicated that the northern Australian form belongs to a new species and can be distinguished from *E. phenax* by a number of traits. This new species is described as *E. pardalota*.

MATERIALS AND METHODS

Terminology, measurements, indices, and abbreviations for anatomical structures follow Roper & Voss (1983), with a few minor differences (Table 1). In the current paper, ASC refers to the total number of suckers on each designated arm (this abbreviation refers to the number of suckers on the basal half of each arm in Roper & Voss (1983), with ASCT

Table 1. Explanation of measurements and counts. Definitions largely follow Roper and Voss (1983). New or modified definitions are indicated by an asterisk (*). Indices (shown in square brackets) are calculated by expressing each measure as a percentage of mantle length

Anterior Mantle Join – **AMJ**: width of attachment of mantle to head [**AMJI**].

Arm Length – **AL**: length of each designated (i.e. 1, 2 etc.) arm measured from first basal (proximal-most) sucker to distal tip of arm (Arm 1, dorsal; 2, dorso-lateral; 3, ventro-lateral; 4, ventral) [**ALI**].

Arm Sucker Count * **ASC**: total number of suckers on each designated arm (e.g. ASC2).

Arm Sucker diameter – **AS**: diameter of largest normal sucker on each designated (i.e. 1, 2 etc.) arm [**ASIn**].

Club Length – **CIL**: length of tentacular club measured from proximal-most basal suckers (carpus) to distal tip of club [**CILI**].

Club Row Count – **CIRC**: number of suckers in transverse rows on tentacular club.

Club Sucker diameter – **CIS**: diameter of largest sucker on tentacular club [**CISI**].

Egg Diameter – **EgD**: diameter of largest egg present in the ovary or oviduct [**EgDI**].

Eye Diameter – **ED**: diameter of eye [**EDI**].

Fin Insertion – **FI**: length of fin as joined to mantle [**FIH**].

Fin Insertion anterior * – **FIA**: anterior origin of fin measured from mantle margin to anterior-most junction of fin and mantle [**FIHa**].

Fin Width – **FW**: greatest width of single fin [**FWI**].

Free Funnel length – **FFu**: the length of the funnel from the anterior funnel opening to the point of its dorsal attachment to the head [**FFuI**].

Funnel Length – **FuL**: the length of the funnel from the anterior funnel opening to the posterior margin measured along the ventral midline [**FuLI**].

Head Length – **HL**: dorsal length of head measured from point of fusion of dorsal arms to anterior tip of nuchal cartilage [**HLI**].

Head Width – **HW**: greatest width of head at level of eyes [**HWI**].

Mantle Length – **ML**: dorsal mantle length. Measured from anterior-most point of mantle to posterior apex of mantle.

Mantle Width – **MW**: greatest straight-line ventral width of mantle [**MWI**].

Ventral Mantle Length – **VML**: length of ventral mantle measured along midline [**VMLI**].

used for the total number of arm suckers). All measurements are in millimetres (mm). Measurements and counts for individual mature specimens are presented in Table 2; the range of values for each character is expressed in the description as: minimum–mean–maximum (SD). The values for each sex are given separately. Unless otherwise stated, ranges refer to the four mature male and two mature female specimens available for study. The *E. phenax* holotype was measured by the author. In some cases the measurements differ slightly from those tabulated in Voss (1963).

Other abbreviations: AM, Australian Museum; MV, Museum Victoria; NTM, Northern Territory Art Gallery and Museum; WAM, Western Australian Museum.

For scanning electron microscopy, arm and club suckers (and in one case a whole arm) was removed from the middle of designated arms and the tentacular club, mounted, then air dried and examined in a Zeiss Evo LS15 SEM using a Robinson Backscatter detector.

As only two mature female specimens were available for examination, the female reproductive tract was not removed for examination. Similarly, the digestive tract was not removed to avoid excessive damage to type material. Some difficulty was experienced dissecting out the male reproductive tract intact and pinning it out for examination and illustration, despite attempting to do so with valuable type material. Should more, particularly fresh material, become available, it would be useful to examine and fully describe these internal structures. It was not possible to do so for this work.

TAXONOMY

Enprymna Steenstrup, 1887.

Gender feminine. Type species, by original designation, *Iniotheuthis morsei* Verrill, 1881. Recent. Western Pacific and eastern Indian Oceans.

Diagnosis. Broad ligament between head and mantle; commissure greater than one-third of head width. Transverse suckers in 2 or more rows on normal (non-hectocotylied) arms. Stalked suckers in 6 or more transverse rows on tentacular clubs. Left arm 1 hectocotylied in mature males; distally with 2–4 rows of small suckers on elongate, columnar pedicels; suckers with narrow openings and chitinous rims; basal part of hectocotylied arm with normal suckers and 1–2 papillae in ventral sucker row, sometimes bearing tiny sucker(s). Enlarged arm suckers usually present in male (not markedly so in *E. phenax* and *E. pardalota* sp. nov.). Paired light organs in mantle cavity, ventral and closely adherent to ink sac. Gladius absent.

Enprymna pardalota sp. nov.

(Figs 1–9; Tables 1, 2)

Material examined. HOLOTYPE – NTM P.15796, 1♂ (8.6 mm ML, mature), Western Australia, Timor Sea, Cartier Reef, rotenone station on slope, 12°32'S, 123°33'E, 13 m, coll. H.K. Larson and M. Selway, 15 March 1990.

PARATYPES – NTM P.2496, 1♀ (7.8 mm ML, mature), Western Australia, Timor Sea, Cartier Reef, southern reef flat, rotenone station, 12°32.8'S, 123°32.3'E, 0.2–0.6 m, coll. R.C. Willan, 5 May 1992; NTM P.2497, ♀ (9.0 mm ML, mature), Western Australia, Timor Sea, Cartier Reef,

SW corner, spur and groove region on coral reef at low tide, 12°32.8'S, 123°32.4'E, 10–20 m, coll. B.C. Russell, 8 May 1992; WAM S.34548, 1♂ (8.5 mm ML, mature), Western Australia, Kimberley, northwest end of Long Reef, 13°48'S, 125°47'E, 12 m, coll. F.E. Wells and C.W. Bryce, 17 August 1991; AM C.303908, 1♂ (9.5 mm ML, mature), rotenone station, Queensland, 10°59.980'S, 144°1.220'E, 6 m, coll. Aust. Museum party, Stn Qld 669, 15 January 1993; AM C.456837, 1♂ (9.4 mm ML, mature), Queensland, Great Barrier Reef, E of Lizard Island, Yonge Reef, 1 m N of platform, coral and sand, back reef, 14°35.00'S, 145°37.00'E, 1–15 m, coll. D.F. Hoese, 1 December 1978.

NON-TYPE MATERIAL – NTM P.17968, 1 juvenile (2.8 mm ML, immature), Australia, Western Australia, Timor Sea, boat anchorage off West Island, Ashmore Reef, attracted to light at night, 12°14'S, 122°56'E, 0.5 m, coll. H.K. Larson, 15 September 1987; NTM P.15788, 2 juveniles (3.2 mm, 3.5 mm ML, immature), Western Australia, Timor Sea, Ashmore Reef, surface, attracted to light, 12°25'S, 122°57'E, 0.5 m, coll. H.K. Larson, 13 September 1987; NTM P.2494, 1 juvenile (5.2 mm ML, immature), Western Australia, Timor Sea, western end of Cartier Reef, in surge channel on coral reef, 12°32.2'S, 123°31.80'E, 10–14 m, coll. B.C. Russell, 4 May 1992; NTM P.2495, 1♀ (4.3 mm ML, immature), Western Australia, Timor Sea, SW corner of Cartier Reef, 12°32.6'S, 123°32.2'E, 8–15 m, coll. B.C. Russell, 9 May 1992; AM C.453180, 1♂ (7.0 mm ML, immature), Queensland, Great Barrier Reef, Linnet Reef, W side, 14°47.00'S, 145°20.00'E, 3–15 m, coll. Australian Museum, 22 November 1975; AM C.456838, 1♂ (7.3 mm ML, immature), Queensland, Great Barrier Reef, Capricorn Group, One Tree I., fine sandy sediment, 23°30.00'S, 152°28.00'E, 4 m, coll. G. Anderson, 7 February 1975.

Other material examined. *Euprymna phenax* Voss 1962: HOLOTYPE – USNM 575328, 1♂ (11.0 mm, mature), Philippines, Panay Island, Naso Point [not Nogas Point as stated in Voss, 1962], 11°10'N 122°30'E, dip net, coll. *FV Albatross*, 3 February 1908; AM C.453179, 1♂ (8.1 mm ML, immature), Philippines, Luzon I., Lingayen Gulf, coral, rotenone, 16°26.00'N 119°55.00'E, 2–15 m, coll. D.F. Hoese and party, 16 April 1980.

Diagnosis. Small species, up to 9.5 mm mantle length. Funnel organ dorsal element spade-shaped. Left dorsal arm hectocotylised in male: basally, 2 pairs of normal suckers; third sucker pedicel in ventral row modified into distally directed, enlarged, fleshy papilla, without terminal sucker; following 2–3 rows suckers normal; distal end of arm bears 9–15 pairs of suckers on enlarged columnar sucker pedicels. Spermatophores with discrete cement body, SL1 46.5–75.8. Preserved specimens cream with large, deep purple irregularly-shaped pigment spots on dorsal and ventral head and mantle. Fins with 1–3 large spots close to junction with mantle. Aboral surface of arms with medio-longitudinal row of large dark purplish blotches and smaller spots between base of each sucker and extending on to

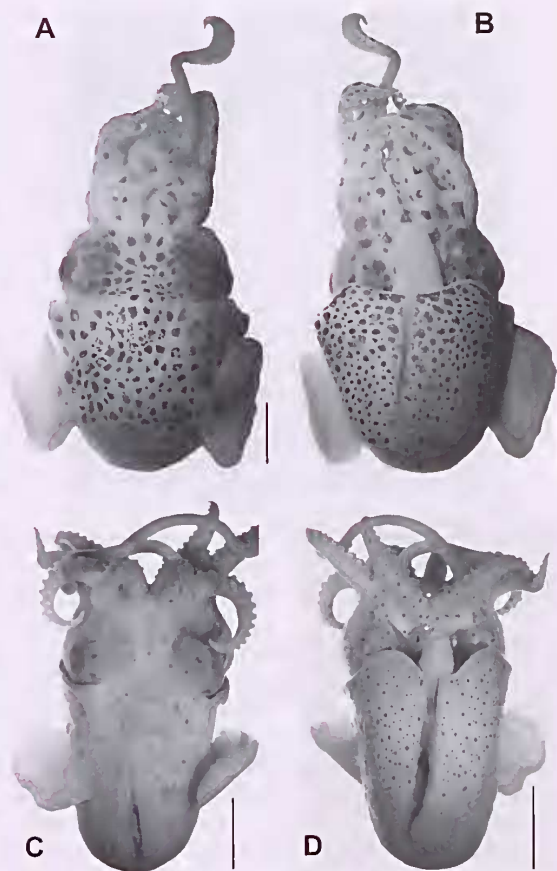


Fig. 1. *Euprymna pardalota* sp. nov.: A, dorsal view, male holotype, NTM P.15796, 8.6 mm ML, scale bar 3 mm; B, ventral view, same specimen, scale bar 3 mm. *Euprymna phenax* Voss: C, dorsal view, male holotype, USNM 535328, 11.0 mm ML, scale bar 3 mm; D, ventral view, same specimen, scale bar 3 mm.

sucker pedicels. Aboral surface of club with row of large blotches close to keel and smaller blotches or bars and spots toward club margin.

Description. Counts and indices for individual specimens are given in Table 2. Only mature specimens were measured.

Species small: ML mature male 8.5–9.0–9.5 (SD, 0.5), female 7.8–8.4–9.0 (SD, 0.8). Mantle short, broad, dome-shaped, rounded posteriorly; MW1 male 84.2–90.0–101.2 (SD, 7.8), female 70.0–79.9–89.7 (SD, 14). Dorsal mantle joined to head, ventral mantle margin straight or distinct wide 'm' shape. Fins rather small, rounded; fin length approx. 50% ML, F11a male 23.5–30.1–39.5 (SD, 6.8), female 34.6–35.1–35.6 (SD, 0.7); fin width about 20% ML, FW1 male 36.8–40.2–47.1 (SD, 4.7), female 38.5–38.7–38.9 (SD, 0.3), attached dorso-laterally towards posterior half of mantle; posterior margins curved; anterior margins with well-developed lobes, lateral lobes crescentic. Anterior edges of fins do not project to level of anterior mantle margin (Figs 1A, B).



Fig. 2. *Euprymna pardalota* sp. nov., male paratype, NTM P.15796, 8.6 mm ML: A, funnel, scale bar 2 mm; B, funnel organ, scale bar 0.5 mm.

Funnel long, conical, base broad, tapered, projecting anteriorly beyond junction of ventral arms 4 (Figs 1B, 2A); FuLI male 55.3–62.4–69.8 (SD, 6.0), female 66.7–66.7–66.7 (SD, 0); free for most of its length, FFull male 32.7–38.5–41.2 (SD, 3.0), female 35.6–37.0–38.5 (SD, 2.1). Funnel valve small, flaplike, rounded anteriorly. Funnel organ dorsal element broad, spade-shaped, rounded anteriorly broadening posteriorly with small projection medially (Fig. 2B) and indistinct median ridge; ventral elements ovoid with acute anterior tips. Funnel locking cartilage long, narrow, parallel-sided with shallow groove of uniform depth (Fig. 2A). Mantle cartilage compliments funnel member: short straight ridge.

Head broader than long in both sexes, HLI male 42.1–53.9–64.7 (SD, 9.4), female 53.8–55.3–56.7 (SD, 12.6); HWI male 91.6–95.7–100.0 (SD, 3.4), female 93.6–94.0–94.4 (SD, 0.6), only very slightly narrower than mantle width. Eyes large, EDI male 17.0–21.4–25.6 (SD, 4.7), female 19.2–22.4–25.6 (SD, 4.5); ventral eyelids free. Distinct, large photosensitive vesicle on latero-posterior surface of head, posterior and ventral to eye, close to mantle opening. Small pore of unknown function close anterior margin of each eye.

Arms broad basally, tapered distally; order 2:3:1:4 or 2:3:4:1 (Table 2). Arm length index of longest arm in male (ALI2) 61.2–73.1–87.2 (SD, 10.9), female (ALI2) 72.2–74.6–76.9 (SD, 3.3). All arms similar in shape, U-shaped in section; indistinct keels present on median aboral sides of arms 4 only. Sucker pedicels large, each with fine, eurved bilobed lappets on posterior margin. Arms suckers biserial;

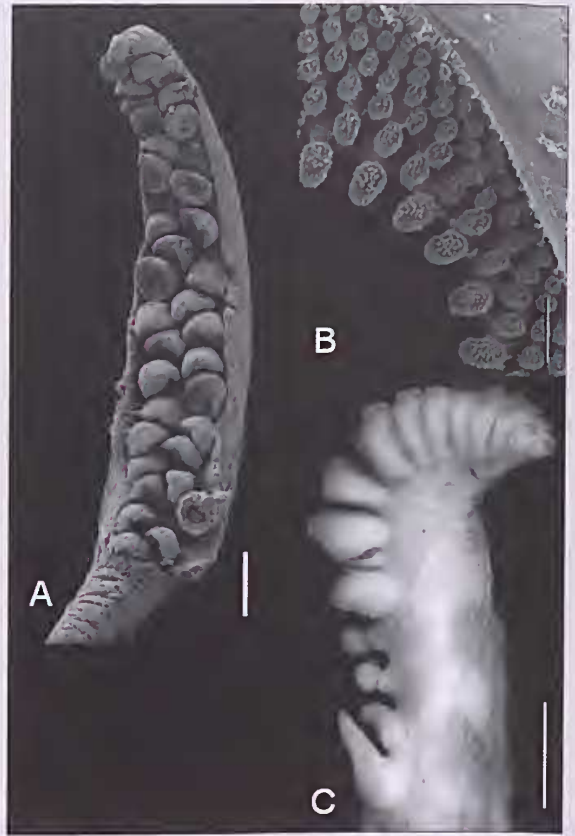


Fig. 3. *E. pardalota* sp. nov. male paratype, AM C.456837, 9.4 mm ML: A, SEM, arm 3, right side, scale bar 2 mm; B, SEM, enlargement of sucker rim, scale bar 10 µm; C, hectocotylus, ventral side view, scale bar 1 mm.

spherical throughout (Fig. 3A). Chitinous rim of arm suckers without teeth on inner margin. Infundibulum with 3–4 rows of stalked processes, with broader, ovoid, outermost rims; processes contain tufts of finger-like papillae (Fig. 2B), peripheral sucker rim processes rectangular, radially arranged, without finger-like papillae. Suckers on arms 2 and 3 larger than those on arms 1 and 4 in both sexes; suckers largest medially, basal few and extreme distal few rows of suckers abruptly smaller. Male arms suckers larger than female arm suckers (Table 2) (but not greatly enlarged). Sucker counts range from 20–32 on each arm, mean sucker counts on arms 1–4 in male 23, 27, 25 and 22 respectively; mean sucker counts on arms 1–4 in female 27, 30, 30 and 24 respectively. All arms connected by relatively shallow webs, protective membranes absent.

Left dorsal arm of male hectocotyliised: basally, 2 pairs of normal suckers (not enlarged or modified); third sucker pedicel in ventral row modified into distally directed, enlarged, fleshy papilla, without terminal sucker; following 2–3 rows suckers normal; distal end of arm bears 9–15 pairs of suckers on enlarged eolumnar sucker pedicels (Fig. 3C); proximal-most sucker pedicels in modified

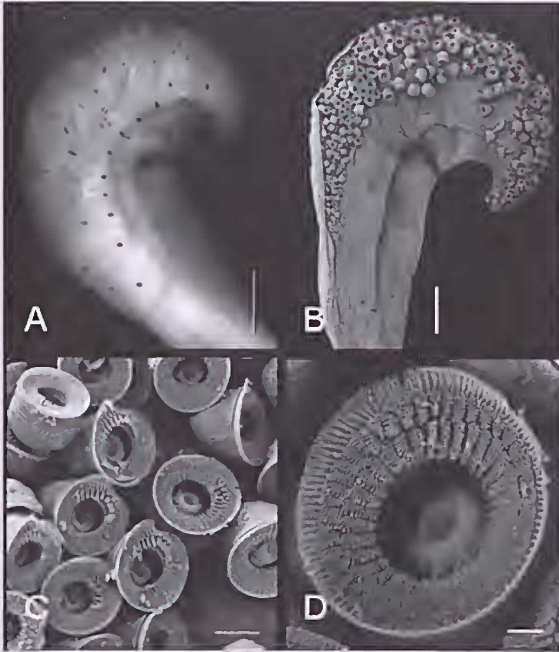


Fig. 4. *Euprymna pardalota* sp. nov. male paratype, AM C.303908, 9.5 mm ML: A, club, scale bar 2 mm; B, SEM, scale bar 400 µm; C, enlargement of elub suckers, scale bar 35 µm; D, enlargement of individual elub sucker, scale bar 10 µm.

portion broadest and separate; distal-most columnar sucker pedicels closely packed. Hectocotyliised arm slightly longer than corresponding unmodified right dorsal arm.

Tentacles long, slender, stalks naked, semicircular in section; oral surface convex. Club relatively short, between 0.25x to 0.3x mantle length; CILI male 22.3–27.5–34.9 (SD, 5.3), female 25.6–28.4–31.1 (SD, 3.9), crescent shaped, tapers to pointed end distally (Fig. 4A, B). Sucker-bearing face of club convex. Suckers approx. 0.1 mm diameter in centre of club; arranged in 6–9 oblique rows. Swimming keel on aboral side of carpus broad, extends posteriorly

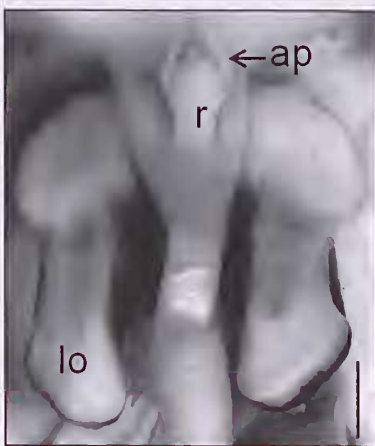


Fig. 5. *Euprymna pardalota* male holotype, NTM P.15796, 8.6 mm ML: lo, light organ; ap, anal papilla; r, rectum; scale bar 0.5 mm.

beyond carpus. Keel forms groove on oral side (Fig. 4A, B). Club sucker dentition (Fig. 4C, D): inner ring without teeth; infundibulum with 3 rows of processes; inner 2 rows sub-rectangular bearing rows of comb-like papillae. At periphery, processes narrower and more elongate, without papillae.

Well-developed paired light organs present overlying and joined to ink sac (Fig. 5). Individual lobes rectangular medially, with large, rounded, shoulder-like bulb anteriorly, slightly enlarged, rounded, posteriorly and angled outer margin.

Gills with 22–23 lamellae per demibranch ($n = 5$).

Buccal membrane with six lappets and fringed inner margin; suckers absent.

Radula with 7 transverse rows of teeth (Fig. 6A). Rhachidian teeth simple, without cusps, triangular, slightly concave laterally and ventrally. First lateral teeth similar in size and shape to rhachidian teeth with pointed cusps displaced laterally and directed towards midline of radula. Second and third laterals with elongate bases, longer than the first, curved. Third laterals with scythe-like teeth, longer than second laterals.

Upper beak (Fig. 6B) with long, pointed rostrum, hood curved, high above crest posteriorly; jaw angle only slightly acute (angle almost 90°); lateral wall edge with slight indentation. Lower beak (Fig. 6C, D) with blunt pointed protruding rostrum, rostral edge obtuse with distinct inner angle; hood pointed posteriorly (Fig. 6D); hood notch absent, wings almost straight, widely spread. Distinct dark pigmentation restricted to rostrum and hood of upper and lower beaks.

Gladius absent.

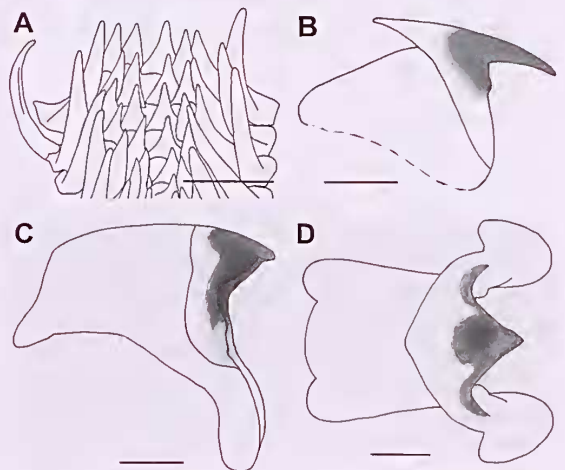


Fig. 6. *Euprymna pardalota*: A, portion of radula, female paratype NTM P.2497, 9.5 mm ML, scale bar 100 µm; B, upper beak, lateral view, male paratype AM C.303908, 9.5 mm ML, scale bar 0.5 mm (broken line indicates damaged margin); C, lower beak, lateral view, male paratype, AM C.456837, 9.4 mm ML, scale bar 0.3 mm; D, lower beak ventral view, same specimen, scale bar 0.3 mm.

Male reproductive tract similar in structure to congeners (Fig. 7). Accessory spermatophoric gland large, well developed. Spermatophores (17 in spermatophore storage sac of specimen AM C.456837) approx. 0.5x to 0.75x mantle length; SpLI 46.5–61.3–75.8 (SD, 14.6, $n = 3$). Sperm reservoir contains coiled sperm cord. Cement body unipartite; aboral end cup-shaped, connects to sperm reservoir via a narrow duct; oral end broadens toward junction with ejaculatory apparatus (Fig. 8A). Oral end of ejaculatory apparatus with 3–4 simple coils.

Female reproductive tract: Ovary large, occupies large proportion of posterior end of mantle cavity; displaces other organs when mature. Opens via single thick-walled oviduct at anterior end on left side. Nidamental glands paired, broad, located ventral to ovary toward anterior end. Inverted cream coloured U-shaped accessory nidamental glands located toward distal end of nidamental glands. Eggs spherical, 0.4 mm diameter ($n = 1$); EgDI 5.1 ($n = 1$).

Colour in alcohol cream with large deep purple irregularly shaped spots, sometimes with darker centres, on dorsal and ventral head and mantle; spots larger on dorsal surface of mantle and head than those on ventral surface (Fig. 1A–B). Shiny bluish iridophores on head around eyes. Fins with 1–3 large spots (usually one large and 1–2 smaller) close to junction with mantle, otherwise chromatophores absent from fins dorsally and ventrally. Aboral surface of arms with medio-longitudinal row of large dark-purplish blotches and smaller spots between base of each sucker and extending on to sucker pedicels. These latter, smaller chromatophores are predominant on ventral side of arms 2–4, with fewer on arms 1. Spots sometimes present between dorsal arm suckers, if present, usually on distal portion of arms. Arms appear barred. Aboral surface of club with row of large blotches close to keel and smaller blotches or bars and spots toward club margin (Fig. 8C). Distinct patterning also visible on juveniles.

Habitat. Coral reef.

Type locality. Western Australia, Timor Sea, Cartier Reef, 12°32'S, 123°33'E, 13 m.

Distribution. Australia: Western Australia, from 12°14'S, 122°56'E to Queensland, 23° 30.00'S, 152° 28.00'E, depth range 0.2 m to 20.0 m (Fig. 9). While the scale of the distribution map would suggest that this species occurs in the open ocean, all specimens collected are, in fact, associated with reefs.

Etymology. The species name, *pardalota*, is derived from the Greek, *pardalots*, meaning 'spotted like a leopard' and refers to the large and prominent spots that are distinctive in this species. It is adjectival.

DISCUSSION

The discovery of a new *Euprymna* in Australian waters is an exciting one. Unlike *E. tasmanica*, this northern Australian taxon clearly differs in having two rather than

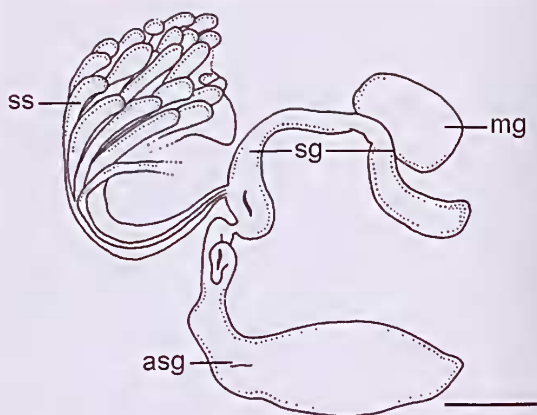


Fig. 7. *Euprymna pardalota*: Male reproductive tract, male paratype, AM C.456837, 9.4 mm ML, scale bar 2 mm. asg, accessory spermatophoric gland; mg, mucilaginous gland; sg, spermatophoric gland; ss, spermatophore storage sac (sac partially broken). Testis (joined to mucilaginous gland) not shown.

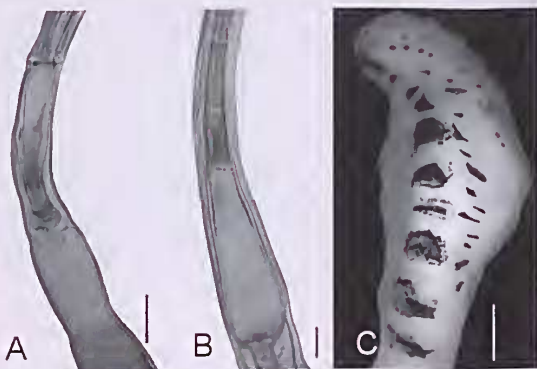


Fig. 8. *Euprymna pardalota*: A, spermatorphore cement body, male paratype, AM. C.303908, 9.5 mm ML, scale bar 0.2 mm. *Euprymna phenax*: B, spermatorphore cement body, male holotype, USNM.575328, 11.0 mm ML, scale bar 0.1 mm. *Euprymna pardalota*: C, aboral view of tentacular club, female paratype, NTM P.2496, scale bar 0.5 mm.

four transverse rows of arm suckers. The only other nominal species with two rows of arm suckers is *E. phenax* from the Philippine islands. Comparison of the *E. phenax* holotype with the northern Australian *Euprymna*, together with a single additional non-type *E. phenax* specimen (also from the Philippines), indicates that the taxon from Australia is distinct.

A number of morphological characters distinguish the specimens from these two localities. *Euprymna phenax* has smaller, and many fewer chromatophores than *E. pardalota* (Fig. 1). The fins of the *E. phenax* (Fig. 1C, D) are smaller and are positioned more anteriorly on the body than those observed in the Australian specimens. The dorsal member of the funnel organ is spade-shaped in *E. pardalota* and inverted V-shape in *E. phenax*. Differences are also apparent in the hectocotylus. While both species have the third sucker pedicel from the base of the arm enlarged into



Fig. 9. *Euprymna pardalota* distribution, diamonds. *Euprymna phenax* distribution, stars. Arrows indicate type localities.

a fleshy papilla, *E. pardalota* has only 2–3 pairs of normal arm suckers distal to this papilla (proximal to the series of columnar suckers), while *E. phenax* has approx. seven pairs of normal suckers distal to the fleshy papilla, followed by about 10 pairs of columnar suckers (versus 9–15 in *E. pardalota*). The fleshy papilla bears a sucker in the *E. phenax* holotype (but not in specimen AM C.453179), but none of the male *E. pardalota* examined had a sucker on this papilla. In addition, based on Voss's measurements, and measurement of the arm suckers of C.453179, the arm suckers are smaller in *E. phenax* males than in *E. pardalota* (Table 2). Variation in the size and arrangement of arm suckers has been used to diagnose other *Euprymna* species (Norman & Lu, 1997). Many of the suckers are absent in the holotype, a fact noted by Voss (1963: 46) who stated, "one cannot overlook the possibility that one or more may be enlarged in a complete specimen". However, the more recently collected non-type *E. phenax* specimen (albeit not fully mature) has intact suckers that are slightly enlarged

Table 2. *Euprymna pardalota* sp. nov. Measurements (mm), counts and indices of mature specimens of both sexes. Measurements for the *E. phenax* holotype are included for comparison (some of Voss' 1963 data were used, for example sucker diameters, as most suckers have now fallen off the holotype).

Museum Reg. no.	NTM P.2496 paratype female	NTM P.2497 paratype female	WAM S.34548 paratype male	NTM P.15796 holotype male	AM C.456837 paratype male	AM C.303908 paratype male	USMN 575328 <i>E. phenax</i> holotype male
ML	7.8	9.0	8.5	8.6	9.4	9.5	11.0
MWI	89.7	70.0	89.4	101.2	85.1	84.2	75.5
AMJI	48.7	44.4	57.6	52.3	47.9	52.6	45.5
VMLI	105.1	105.6	111.8	98.8	98.9	94.7	102.7
FWI	38.5	38.9	47.1	39.5	37.2	36.8	30.0
FIIa	34.6	35.6	23.5	39.5	28.7	28.4	30.0
FII	34.6	35.6	41.2	31.4	34.0	29.5	27.3
FuLI	66.7	66.7	61.2	69.8	55.3	63.2	59.1
FFuI	38.5	35.6	41.2	40.7	37.2	34.7	32.7
HLI	53.8	56.7	64.7	52.3	56.4	42.1	45.5
HWI	93.6	94.4	100.0	95.3	95.7	91.6	83.6
EDI	19.2	25.6	17.6	25.6	17.0	25.3	14.5
ALI1	44.9	55.6	50.6	75.6	63.8	54.7	45.5
ALI2	76.9	72.2	61.2	87.2	69.1	74.7	65.5
ALI3	66.7	66.7	56.5	86.0	63.8	68.4	65.5
ALI4	57.7	50.0	44.7	69.8	53.2	57.9	54.5
ASIn1	4.49	4.44	4.12	5.81	2.66	3.68	2.73
ASIn2	5.13	6.11	5.88	8.14	5.32	5.26	3.18
ASIn3	5.13	5.56	5.88	7.56	5.32	5.26	2.27
ASIn4	4.49	5.56	4.12	5.81	3.62	3.16	2.27
ASC1	28	27	20	24	22	25	32
ASC2	28	32	24	30	24	30	38
ASC3	32	28	24	30	20	24	38
ASC4	24	24	22	24	18	23	28
CIL1	25.6	31.1	26.5	34.9	22.3	26.3	24.5
CIRC	7	8	9	6	7	8	12
CISI	1.28	1.11	1.18	1.16	0.64	0.63	0.45
GilL1	48.7	—	—	41.9	37.2	36.8	—
GilLC	20	23	—	22	22	22	20
EgD1	5.1	—	—	—	—	—	—
SpL1	—	—	—	46.5	61.7	75.8	177.0
SpWI	—	—	—	3.5	5.9	5.3	—

medially on the arms, but definitely not markedly so. The chitinous sucker rims are smooth in *E. phenax*, unlike those of *E. pardalota*. Also, the club has a greater number of suckers in transverse rows (12–14 in *E. phenax*), than those in *E. pardalota* (6–9), and they appear to be slightly smaller. The spermatophores of *E. phenax* are remarkably long (SLI 177 versus 46.5–75.8 in *E. pardalota*) and strangely devoid of internal structure, with a very simple, flask-shaped cement body (Fig. 8B; compare with Fig. 8A).

The ventral mantle margin of the *E. phenax* holotype extends anteriorly into two distinct lobes (Fig. 1D), while the ventral mantle margin extends only as low ridges in the *E. pardalota* specimen shown in Fig. 1B. However, some other *E. pardalota* specimens have strongly projecting lobes, indicating this is a variable trait, perhaps affected by preservation or degree of contraction.

While *E. phenax* is only known from the single male type specimen and one other non-type male, and female *E. phenax* have not yet been described, the available evidence clearly supports the recognition of the Australian taxon as a species new to science. In the future, if more *E. phenax* from close to the type locality are collected and the species can be fully described, this hypothesis can be properly tested. Ideally, a comparison of both morphological and molecular traits over the distributional range of both taxa would be invaluable.

In addition, the discovery among Australian museum collections of a second specimen from the Philippine islands that clearly matches the character traits of the *E. phenax* holotype (until now the only known specimen of that taxon) supports the validity of this species that was previously described as “unresolved” (Norman & Lu 1997).

The generic diagnosis has been modified from that given in Norman & Lu (1997) to accommodate this new species and *E. phenax*. [Steenstrup’s (1887) original description of the genus is a single line only in Latin and refers only to the broad ligament joining the mantle and head and the extraordinary formation of the tentacle.] The arm suckers are now diagnosed as having two or more transverse rows of suckers (rather than four or more); the tentacular clubs have six or more transverse rows of suckers (rather than 16), and most (but not all species) have enlarged suckers in mature males. The light organs are described here as paired rather than a single ‘saddle-shaped light organ’. While the term ‘saddle shaped’ has persisted in the literature, the light organs are not joined anteriorly ventral to the rectum. A more detailed diagnosis awaits a full generic revision. A comprehensive phylogenetic analysis, including morphological and molecular traits, is needed to check the monophyly of *Euprymna*, the position of *E. pardalota* and *E. phenax* within it, and the relationship of this group to other sepiolids.

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